

# SHIKAZONO LAB.

## [Solid Oxide Fuel Cell and Next Generation Heat Engines]

Integrated Research Center for Sustainable Energy and Materials

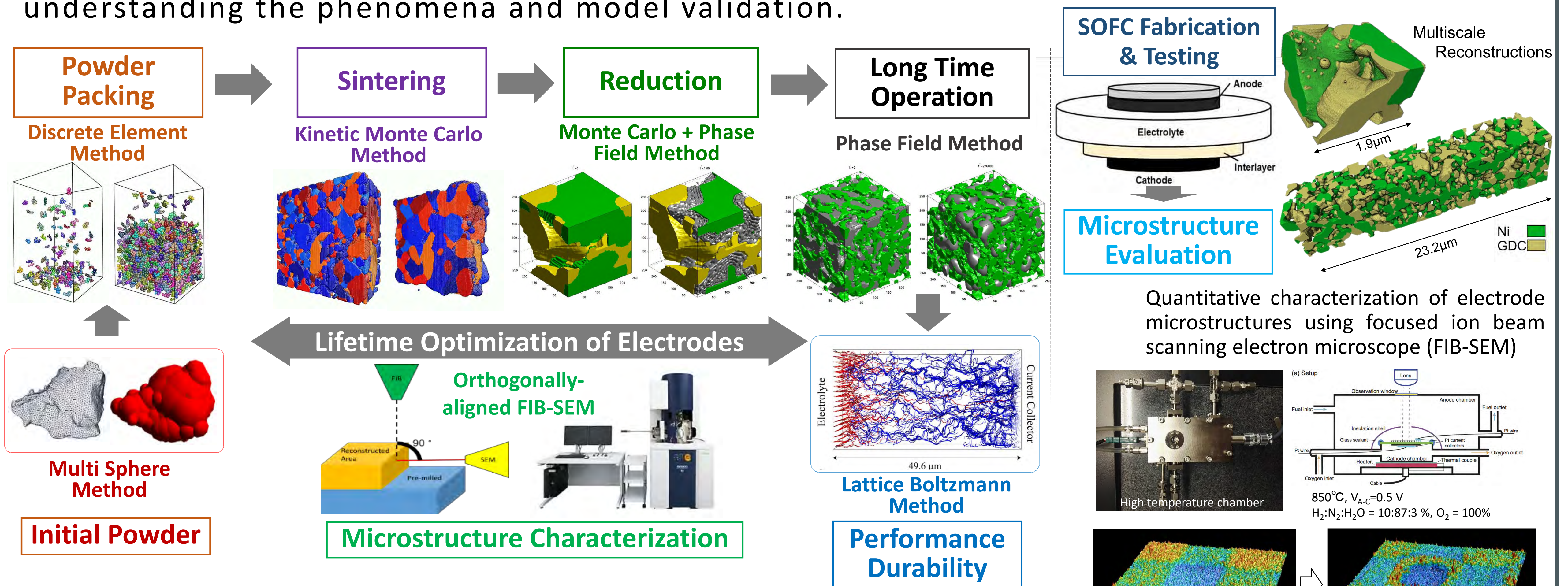
Thermal Energy Engineering

Department of Mechanical Engineering

<http://www.feslab.iis.u-tokyo.ac.jp/>

### Polarization Characteristics and Microstructures of Solid Oxide Fuel Cell Electrodes

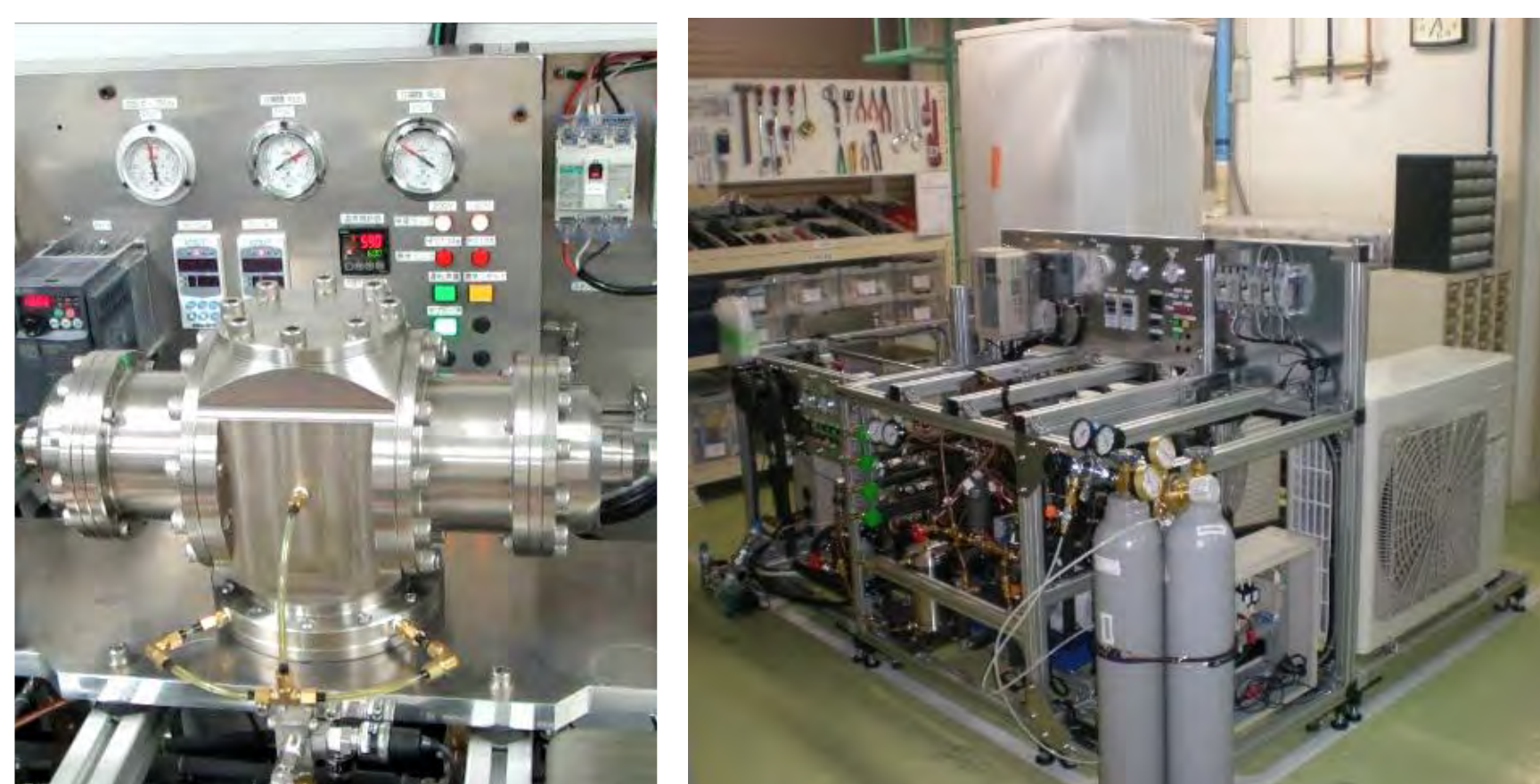
Electrode microstructures strongly affect the polarization characteristics of solid oxide fuel cells (SOFCs). Large-scale numerical simulation tools such as lattice Boltzmann, phase field, kinetic Monte Carlo and discrete element methods are developed to optimize the whole lifetime characteristics of the electrodes from initial powder to long time operation. Three dimensional microstructures reconstruction by FIB-SEM and In operando observations play inevitable role for understanding the phenomena and model validation.



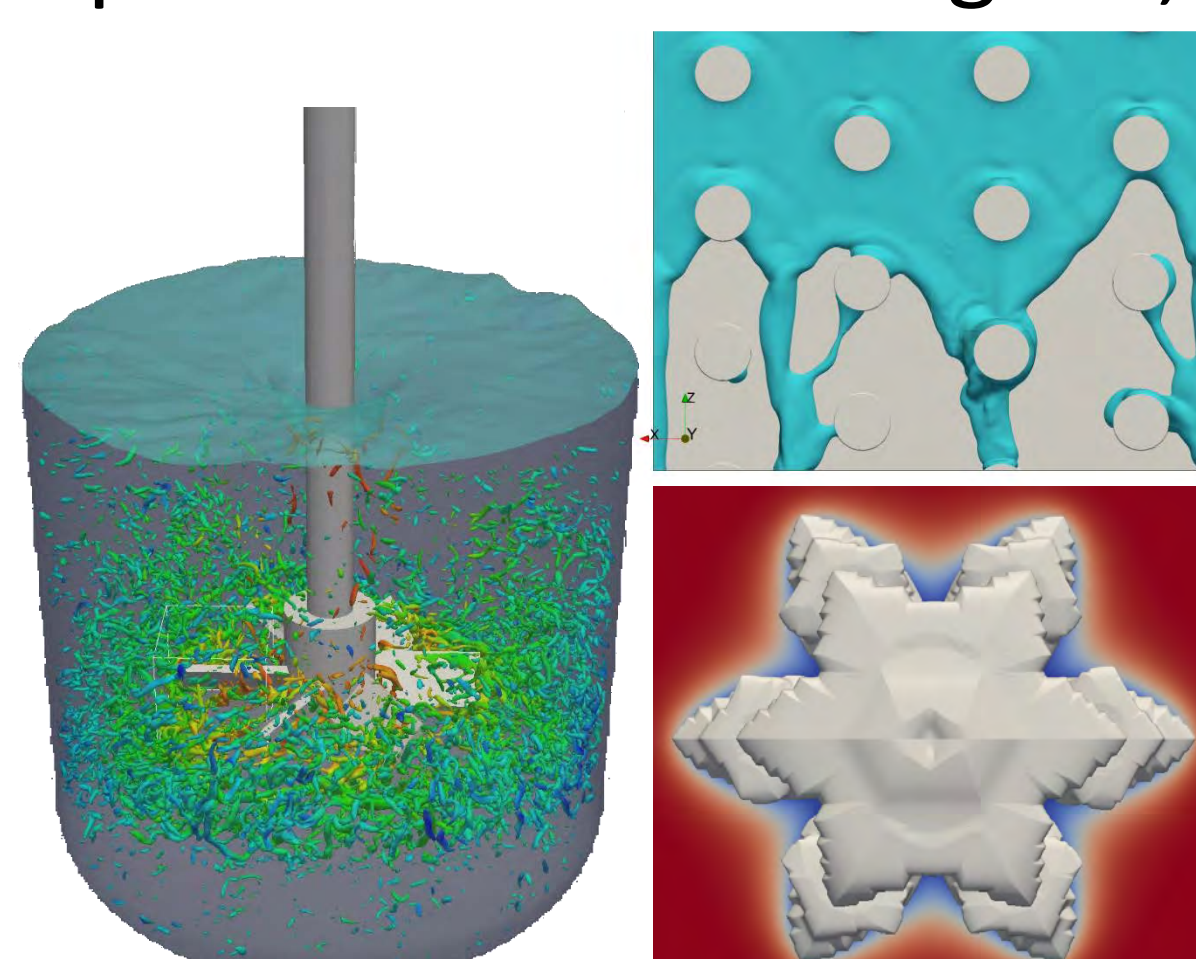
### Next Generation Heat Engines

Efficient utilization of thermal energy has become even more important in the present energy systems. In order to reduce exergy loss, heat engines which operate at small temperature differences, and component technologies such as efficient heat exchangers and gas-liquid separators are developed under collaboration with industry partners.

- Development of two phase expansion steam cycle (Trilateral steam cycle)
- Large-scale simulation and optimization using supercomputers
- Development of component technologies: heat transfer enhancement, compact gas-liquid separators, compact heat exchangers, etc.



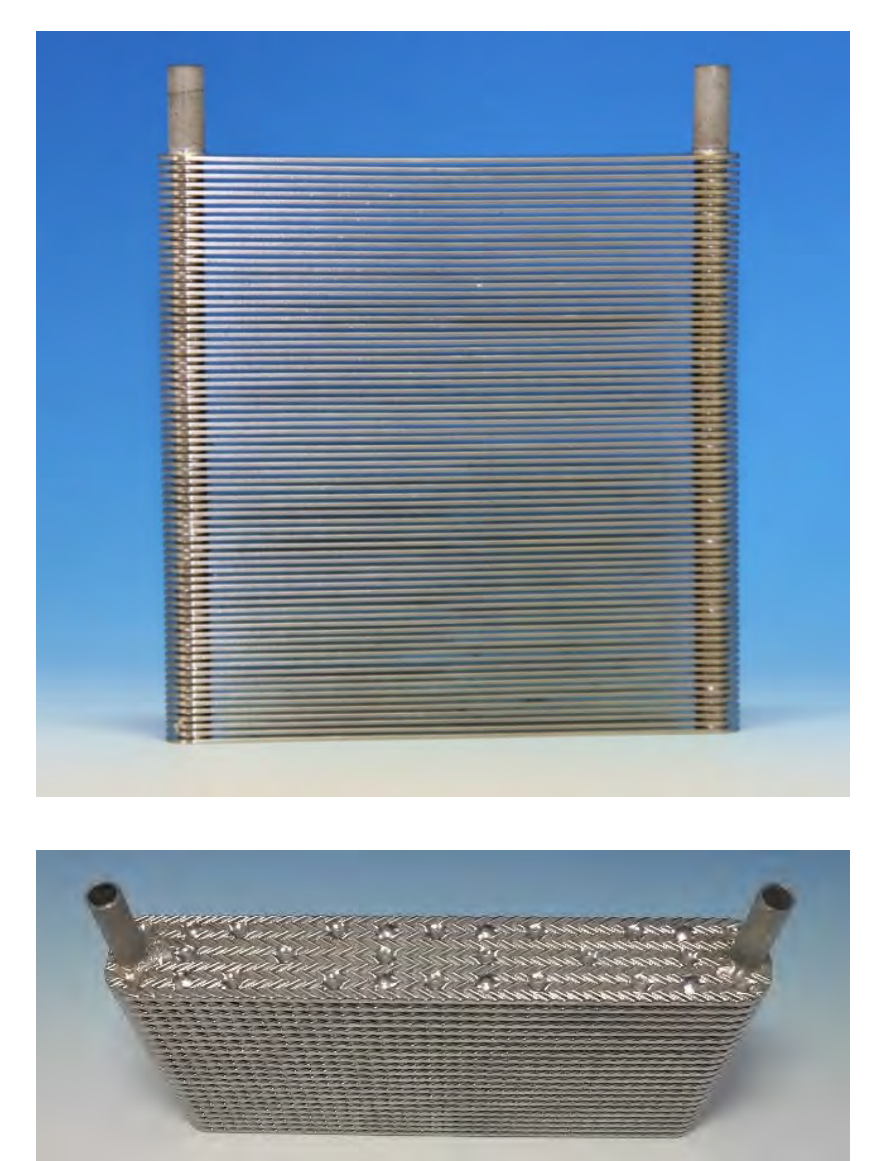
Two phase expander & demonstration unit for Trilateral steam cycle



Large scale numerical simulations of complex thermal systems



High performance & anti-scale V-fins



Compact finless heat exchangers